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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

LEE, EUGENE

ART UNIT PAPER NUMBER

2815

DATE MAILED: 07/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/736,859

Applicant(s)

YAO, JIE

Examiner

Eugene Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 July 2005.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
4a) Of the above claim(s) 14 and 15 is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-13 and 16-18 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 16 December 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 12/16/03, 01/23/2004
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Claims 14, and 15 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 7/18/05.
2. Applicant's election with traverse of Species I in the reply filed on 7/18/05 is acknowledged. The traversal is on the ground(s) that Claim 1 covers both Figs 1 and Fig. 2. This is not found persuasive because the restriction was based on the species of the applicant's invention, and since claims 1-13, and 16-18 identify species I (p-i-n diode) of the applicant's invention, the requirement is still deemed proper and is therefore made FINAL.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the $t_n=0$ (claim 3), and $t_p=0$ (claim 4) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

It appears the figures (i.e. Fig. 1) only show the p-doped light absorption layer and an n-doped light absorption layer having a thickness wherein if $t_n=0$ and $t_p=0$, there would be no p-doped light absorption layer and n-doped light absorption layer.

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Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

4. Claims 8, and 9 are objected to because of the following informalities: in line 2 of said claims, the word "of" is missing. Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

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6. Claims 3, and 4 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

It is not clear how $t_n = 0$ and $t_p = 0$ (thereby effectively making no p-doped light absorption layer or n-doped light absorption layer) when it is part of photodiode. A device without a p-doped light absorption layer or n-doped light absorption layer is not a photodiode.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Coroy 6,492,704 B1. Coroy discloses (see, for example, FIG. 4) a photodiode comprising comprising an intrinsic semiconductor material (semiconductor intrinsic light absorption layer) 52 having a thickness, p-type material (p-doped light absorption layer) 42 having a

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thickness, n-type material (n-doped light absorption layer) 44 having a thickness, and electrical contacts (cathode electrode and an anode electrode) 46. The thickness of the intrinsic semiconductor material, p-type material, and n-type material are substantially equal, and therefore, the sum of the thickness of the p-type material 42 and the n-type material 44 divided by the thickness of the intrinsic semiconductor material 52 is greater than 0.17.

9. Claims 1, 2, and 5 thru 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Goossen et al. 4,904, 859. Goossen discloses (see, for example, FIG. 1) a semiconductor device (photodiode) 110 comprising an intrinsic layer (semiconductor intrinsic light absorption layer) i, p-type region (p-doped light absorption layer) 111, n-type contact region (n-doped light absorption layer) 112, and contact pads (cathode electrode and anode electrode) 116, 117. In column 4, lines 35-39, Goossen discloses the p-type contact region having a thickness of 7000 Å; in column 4, lines 14-22, Goossen discloses the layers of the n-type contact region collectively being greater than 1000 Å + 1000 Å; and in column 4, lines 25-29, column 4, lines 23-25, and column 4, line 35, Goossen discloses the intrinsic layer comprising a quantum well region 114 being 500 Å, GaAs spacer layer 115 being 500 Å, and intrinsic spacer layer 113 being 500 Å respectively. These thicknesses clearly discloses the relationship wherein $(t_p + t_n) / t_i$ is greater or equal to 0.17 since the p-type is many times greater already than the intrinsic layer.

Regarding claim 2, see, for example, column 4, lines 39, wherein Goossen discloses the p-type region having a concentration of 10^{18} atoms/cm³ (dc in between $1e16$

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and $5 \times 10^{18} \text{ cm}^{-3}$) and column 4, lines 18, wherein Goossen discloses the n-type region having a concentration of $10^{18} \text{ atoms/cm}^3$ (dc in between 1×10^{16} and $5 \times 10^{18} \text{ cm}^{-3}$).

Regarding claim 6, see, for example, column 4, lines 25-26, wherein Goossen discloses the quantum well region as undoped (doping below $5 \times 10^{14} \text{ cm}^{-3}$).

10. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Bigan et al. 5,073,809. Bigan discloses (see, for example, FIG. 9B) a PIN diode (photodiode) comprising an intrinsic layer (semiconductor intrinsic light absorption layer) I, side (p-doped light absorption layer) P, side (n-doped light absorption layer) N, and metallic films (cathode electrode and anode electrode) 20, 22. The thickness of the P side and N side are clearly greater than the intrinsic layer I, and thus discloses the relationship wherein $(t_p + t_n) / t_i$ is greater or equal to 0.17

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. Claims 2, and 5 thru 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bigan et al. 5,073,809 as applied to claim 1 above, and further in view of Pankove et al. 4,069,492. Bigan does not disclose the p-doped light absorption layer and the n-doped light absorption layer having a doping concentration of dc in between 1×10^{16} and $5 \times 10^{18} \text{ cm}^{-3}$. However, Pankove discloses (see, for example, column 37-41) a PIN semiconductor

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device comprising a P type first doped layer 13 and a N type second doped layer 15 with both layers having concentrations greater than $10^{18}/\text{cm}^3$ of dopants. It would have been obvious to one of ordinary skill in the art at the time of invention to have the p-doped light absorption layer and the n-doped light absorption layer having a doping concentration of dc in between $1e^{16}$ and $5e^{18} \text{ cm}^{-3}$ in order to form the adequate p doped layers and n doped layers in a PIN device, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

13. Claims 16 thru 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bigan et al. 5,073,809 as applied to claim 1 above, and further in view of Jang et al. "P-I-N Photodiodes in Metamorphic InAlAs/InGaAs/GaAs for Long Wavelength Applications". Bigan does not disclose the doped and intrinsic absorption layers being InGaAs lattice-matched to InP. However, Jang discloses (see, for example, first paragraph) photodetectors typically having InGaAs lattice matched to InP. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have the doped and intrinsic absorption layers being InGaAs lattice-matched to InP in order to operate at long wavelengths, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

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INFORMATION ON HOW TO CONTACT THE USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugene Lee whose telephone number is 571-272-1733. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 571-272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Eugene Lee
July 21, 2005

A handwritten signature in black ink, appearing to be 'E. Lee', written in a cursive style.